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"Bioterrorism Preparedness Through Public Health And Medical Bio-Surveillance"

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BIOTERRORISM PREPAREDNESS THROUGH PUBLIC HEALTH AND MEDICAL BIO-SURVEILLANCE

Introduction

The first sign of a biological weapons or bioterrorism attack may be as inconspicuous as a flag on a computer screen in a small community. Yet this seemingly innocuous and lonely signal could mark the beginning of a national public health nightmare and response to a biological weapons attack. A bioterrorism attack may sneak up on cat's paws, following an insidious and unpredictable course and making itself known slowly and intermittently over a period of days or weeks. It may appear in places as disparate as doctor's offices, health clinics, and hospital emergency rooms. If not contained, its effects could spread to others not initially exposed, causing an epidemic and threat to our national security and the survival of our population.'

The initial impacts of a bioterrorism attack are likely to fall on emergency medical personnel rather than traditional first responders.[2] Defending against such an attack requires a strong public health and medical infrastructure. Robust and sensitive disease and epidemiological surveillance systems, or bio-surveillance, are critical to this infrastructure because they can detect such attacks early on and quickly identify and distinguish between naturally occurring diseases and intentional releases. Disease surveillance involves the ongoing systematic collection, analysis, and interpretation of specific data needed to plan and implement public health measures. Epidemiology studies the prevalence and spread of disease in a community, its causes, modes of transmission, and distribution.[3] Laboratory networks and knowledgeable health care professionals who can determine populations at risk and when person to person spread may occur are also key components of this infrastructure.[4] This paper reviews different bio-surveillance programs that are being planned or implemented throughout

government and in the private sector and proposes policy recommendations to improve and strengthen these efforts.

Bioterrorism Threats and Public Health Protection

The United States (U.S.) faces daunting challenges in preparing for biological terrorism. Technological advances will make biological weapons more lethal, accessible, and affordable and future attacks will likely involve diseases that occur infrequently in nature. Medical and public health authorities may have limited experience dealing with these diseases because they won't follow known epidemiological patterns. Even worse, outbreaks could occur simultaneously in multiple locations, which is less likely in a natural epidemic. [5] Contagions can spread throughout the population contiguous to the event and by persons dispersing them during the incubation period. It is conceivable that genetically engineered biological weapons can consist of more virulent disease agents having greater destructive potential than natural diseases. [6] Smallpox; typhoid; typhus; anthrax; plague; viral hemorrhagic fevers (Ebola, Marburg, and Lassa); aflatoxin; and botulinum and shigella toxins comprise some of the most dangerous bio-agents and their use as weapons is indeed frightening. Disease agents can be transmitted through injection; direct contact; food, water, or pharmaceutical contamination; animal vectors; and airborne release. [8]

U.S. military forces are relatively well prepared for bioterrorism attacks, but the U.S. as a whole is far from-having solutions to deal with large-scale treatment of the civilian population following a biological attack. [9] The Department of Health and Human Services (HHS), particularly the Public Health Service and the Centers for Disease Control and Prevention (CDC), is responsible for managing the health effects of terrorist attacks. [10] Policyrnakers are most concerned about attacks involving biological agents like smallpox, anthrax, plague, and

tularemia that can have widespread population impacts.[1] Defending against such attacks requires reliable and rapid capabilities to detect signs of an attack early on to identify its nature and location. Information can be gathered through intelligence, sensors, disease and epidemiological surveillance, and agricultural disease monitoring.[12] Bio-surveillance systems are playing an increasingly important role in the front line defense against bioterrorism and in our national health care security. Several sophisticated systems have been successfully tested and implemented and are discussed below.

Bio-surveillance and Detection Systems

The national concept of operations for an early bioterrorism response relies heavily on bio-surveillance to detect attacks. Surveillance to detect, collect, analyze, and interpret reports of bio-events and trained staffs to monitor disease outbreaks is the foundation of epidemiology. The concept is that sudden spikes in everyday aches and pains may signal the early stages of a massive biological attack. Epidemiologists call this strategy "syndromic" surveillance because it looks for increases in clusters of symptoms or "syndromes," rather than particular disease diagnoses.[13] Both passive and active bio-surveillance systems are used throughout the country. Passive systems rely on voluntary disease reporting from health care providers, but are notorious for low sensitivity, lack of timeliness, and minimal coverage.[14] Since passive systems are relatively inexpensive, they comprise the majority of surveillance systems, but are not very reliable because physicians and hospitals frequently fail to make an initial report or do so in a timely manner.[15] Active bio-surveillance, on the other hand, requires the active search for and identification of new cases and provides more timely and accurate information, but it also requires more trained epidemiologists and health care workers to collect, compile, and analyze the data needed to determine` the source of the biological agent.[16]

In recent years, the number of health threat surveillance and detection programs implemented nationwide has increased. Many are funded and sponsored by the federal government in cooperation with the state and local public health and medical communities. At the local level, bio-surveillance systems often audit fluctuations in hospital admissions, monitor incoming patients, and draw data from emergency management system activity levels. [17] State health departments use bio-surveillance to identify statewide hospital admission rates and map the geographic and temporal evolution of diseases. This helps to differentiate disease patterns and determine if a disease is contagious and natural. [18] Below is a discussion of some sample federal, state, and local bio-surveillance activities.

Federal Activities

The CDC funds several programs designed to improve bio-surveillance capabilities. The *Emerging Infections Program* (EIP) works with academia, local health departments, and hospital infection control practitioners in nine states to assess the public health impacts of emerging infections, food-borne diseases, unexplained illnesses, and deaths and to evaluate prevention and control methods. [19] *Exemplar Centers* in health departments in DeKalb County, Georgia, Denver, Colorado, and Monroe County, New York, are also funded to develop integrated communications and information systems, operational readiness assessments, and comprehensive training. [20] CDC sponsors the *Epidemic Intelligence Service,* a postgraduate epidemiology program for health professionals who serve in national and international epidemiological programs and assist state health departments in conducting research and public health bio-surveillance. [21]

Other related CDC-sponsored programs include the *Epidemiology and Laboratory Capacity for Infectious Diseases Cooperative Agreement* (ELC); *Epi-Info; Epidemic Information*

Exchange (EPI-X); *Health Alert Network* (HAN); *Laboratory Response Network* (LRN); and *National Electronic Disease Surveillance System* (NEDSS). ELC supports improvements in epidemiological and laboratory capacity and collaboration in all 50 states. *Epi-Info* provides public domain software to public health officials to improve their access to and use of epidemiological information. EPI-X provides a web-based communications network for rapid exchange of urgent public health information and HAN provides a national information and communication platform for distribution of health alerts, prevention guidelines, and bio-surveillance data. LRN is a joint program between CDC and the Association of Public Health Laboratories designed to ensure the existence of and upgrade public health lab sampling and specimen handling capacities. NEDSS promotes the development of integrated and interoperable bio-surveillance systems.[22]

Several other federal departments are also developing or implementing bio-surveillance systems. The Department of Defense, under its Global Emerging Infections System, has developed a prototype system, the *Electronic Surveillance System for the Early Notification of Community-based Epidemics* (ESSENCE), for early detection of infectious disease outbreaks at military treatment facilities. ESSENCE conducts active syndromic surveillance of patients visiting military treatment facilities around the world and compiles data daily for analysis and forecasting.[23] The Department of Homeland Security is installing biological agent detectors nationwide at 3,000 Environmental Protection Agency environmental monitoring stations. This new system can rapidly relay suspicious air filter results to the closest of 120 CDC labs for analysis.[24] The Defense Threat Reduction Agency is deploying a *Biological Defense Homeland Security Support Program* for the early detection and characterization of biological attacks in urban environments.[25] The U.S. Army's Program Executive Office for Chemical and Biological

Defense is developing *ESSENCE II,* a prototype urban monitoring system that will upgrade *ESSENCE. ESSENCE II* will provide new data integration tools and an enhanced bio-surveillance network to deliver earlier warning of biological attacks. [26] The Department of Energy operates two civilian medical bio-surveillance systems that will be incorporated into *ESSENCE II,* the *Bio-Surveillance Analysis Feedback Evaluation and Response* system and the *Rapid Syndromic Validation Project.* Both systems use traditional and non-traditional indicators to focus on symptoms indicating possible exposure to biological agents. [27] The Defense Advanced Research Projects Agency is developing the *Spectral Sensing ofBio Aerosols* program for use as a national biological threat detection system. [28]

State and Local Activities

Two unique electronic bio-surveillance systems were tested during the 2002 Winter Olympic Games in Salt Lake City, Utah, and continue to operate in conjunction with the University of Utah health sciences center. These systems, the *Advanced Logic for Event Detection in Real Time* (ALERT) system and the *Real-Time Outbreak and Disease Surveillance* (RODS) system detect in real time patterns of symptoms indicating a possible bioterrorist attack or disease outbreak . [29] ALERT tracks patients seen daily in the Utah University Hospital emergency department and clinics or admitted to the hospital; their complaints, diagnoses, and demographics; and laboratory and radiology test results. [30] RODS, developed by the University of Pittsburgh Medical Center and Carnegie-Mellon University, captures large cohorts and examines on a real time basis patient complaints. Complaints can then be mapped to one of seven syndromes relating to bioterrorism, for example linking respiratory complaints to anthrax, rashes to smallpox, and hemorrhagic fever to ebola. [31] RODS researchers are developing a new bio-surveillance system, *Patient and Population-Based Anomaly Detection and Assessment,* to

collect and compare overall population data with individual patient data to assess the risks of unanticipated diseases.[32]

New York City initiated syndromic bio-surveillance in 1999 and analyzes data from hospital emergency rooms, the 911 system, and ambulance dispatches to detect sudden spikes in symptoms. Drugstore sales data and absentee statistics from employers and schools are also analyzed. Seattle, Washington's, health department monitors reports from hospital emergency rooms, primary care clinics, and 911 dispatches; Baltimore, Maryland's, health department collects data on dog and cat deaths, school absenteeism, and cold medicine sales; and Kansas City, Missouri's, health department collects microbiology and lab data as part of bio-surveillance activities.33[34] Many other syndromic and bio-surveillance systems are in place in states and communities across the country.

Private Sector and Academic Activities

Several bio-surveillance projects are also underway involving the private sector. CDC iss sponsoring the Harvard Consortium (Harvard Medical School; Harvard Pilgrim Health Care; Harvard Vanguard Medical Associates; Brigham and Women's Hospital; Kaiser Permanente-Colorado; Health Partners Research Foundation-Minnesota; American Association of Health Plans; and Optum) in developing a pilot early-warning bio-surveillance network as a possible national model.[35] Health organizations in Denver, Boston, and Minneapolis were selected because they have health systems with online medical records accessible daily. Optum was chosen to collect records nationwide.[36] In another example, Siemans Medical Solutions initiated a Health Surveillance Network this year linking 225 hospital emergency departments across Pennsylvania. This program is the first on this scale to operate under homeland security legislation authorizing states to institute programs to detect bioterrorism threats, disease

outbreaks, and epidemics.[37] In a third example, Johns Hopkins University and the University of Maryland will partner on a bio-surveillance project in the Baltimore area.[38] Each of these examples illustrates serious attempts to help secure the nation from bioterrorism threats, but more attention is needed.

Recommendations for Improving Capabilities in Bioterrorism Surveillance

In today's dangerous world, we must not lose sight of the fact that infectious diseases anywhere can threaten public health everywhere and that threats to public health also threaten national security. The worldwide emergence of new infectious diseases and the re-emergence of old ones led a recent National Intelligence Estimate to conclude that new and emerging infectious diseases pose a rising global threat and will complicate U.S. and global security in the next 20 years.[39] We must continue to upgrade our bio-surveillance capabilities, not only for detection of bioterrorist attacks and national security, but also to manage natural disease epidemics. As George White Jr., Director of Public Health Programs at the University of Utah, correctly pointed out, "An early surveillance system all across America will be an unbelievable benefit for us in combating natural diseases, and a sheer necessity to respond rapidly and appropriately to biological agents."[40]

While it is certainly reassuring to see such a high level of bio-surveillance program activity, there remains an urgent need to do more. Since the front lines of bioterrorism defense are at the state and local levels, this is where efforts must be focused to upgrade public health and medical bio-surveillance capabilities. The core capacities of the medical and public health infrastructure need to be augmented with additional training and resources to support continued improvement of bio-surveillance capabilities. Beyond this, it is important for the federal government to assume a much stronger leadership role and more effectively coordinate all of the

different bio-surveillance efforts that are underway across the nation. These recommendations are discussed in more detail below.

A national core of first responders and public health and medical providers should be trained to recognize clusters of symptoms and unusual diseases that may portend an emerging health problem or signal a biological attack. Partnership activities and training are needed to reinforce the vital link and close cooperation that is so important between the public health community and medical providers so that each understands the importance of supporting the other in detecting bioterrorism.[41] Distance learning provided through medical, public health, and academic associations can facilitate training and the formation of closer partnerships.

CDC should increase efforts to enhance epidemiological expertise and upgrade diagnostic lab capacities and collaboration, especially at the local level. Development of standard reporting formats, more highly integrated and reliable communications and data management systems, and more comprehensive computer linkages will facilitate rapid collection, analysis, and information exchange between labs, public health departments, the medical provider community and research facilities. Regional centers should be established for quick data compilation and analysis and forging of necessary communications links.[42] The entire medical and public health care community must be connected to HAN and EPI-X and the public health, medical, and scientific communities must work in closer partnership to research biological agents and diseases.[43] Greater cooperation in all areas can produce bio-surveillance, predictive, and detection devices with dual uses in national security and routine health care.[44] All states should enact the Model State Emergency Health Powers Act (MSEHPA), which gives states increased legal powers to detect and contain bioterrorism and natural disease outbreaks. MSEHPA also contains specific provisions on surveillance activities.[45]

Most importantly, strategic leadership and strong commitment are needed at the federal level to achieve the cohesion and coordination needed to improve bio-surveillance and related activities. Experts stress that it is not so much that new programs are needed, but a more coordinated approach that improves and augments current programs.[46] In 2001, the Secretary of HHS appointed a special assistant to coordinate bioterrorism programs and established a command center to monitor bioterrorist attack information.[7] This is a step in the right direction, but falls short of what is needed. A "bioterrorism czar" with greater authority and national visibility, perhaps even reporting to the President, is needed. This person would be responsible for coalescing the fragmented bio-surveillance and related preparedness activities into a comprehensive public/private national program and serving as the national advocate for obtaining the additional resources needed for improvement. Upgrading our nation's bio-surveillance capabilities should be a national goal pursued with the same vigor as missile defense and landing a man on the moon. This effort must be viewed in the context of funding to improve health, defense, and homeland security since it will serve to help deepen the nations's protective shield and defenses against bioterrorism.

Conclusion

Biological weapons attacks may be very ambiguous and difficult to distinguish from natural disease outbreaks. Whether natural or intentional, rapid and accurate detection and. analysis of disease threats will be critical to protecting health and safety. Protecting this country from acts of bioterrorism will require fully coordinated, creative, and collaborative public/private programs that maximize bio-surveillance and detection tools. Public health is a critical pillar of the national security framework. The future health and prosperity of this nation may well depend on how strong we make this pillar.

Endnotes

[1] U.S. Senate Committee on Governmental Affairs. *The State of Public Health Preparedness for Terrorism Involving Weapons of Mass Destruction: A Six-Month Report Card.* (April 18, 2002). 107' Congress. Second Session. S. Hrg. 107-507. Washington, D.C.: U.S. Government Printing Office, 2002. pp. 2-3.

[2] Judith A. Ward. *Homeland Defense: Are We There Yet?* (Maxwell Air Force Base, Alabama: Air University, USAF Counterproliferation Center, The Counterproliferation Papers, Future Warfare Series, No. 11, April 2001). p. 11.

[3] Eileen Salinsky. Senior Research Associate. *Public Health Emergency Preparedness: Fundamentals of the "System."* (Washington D.C.: The George Washington University, National Health Policy Forum, April 3, 2002). p. 5.

[4] Sidney D. Drell; Abraham D. Sofaer; and George D. Wilson. Editors. *The New Terror: Facing the Threat of Biological and Chemical Weapons.* (Stanford, California: Stanford University, Hoover Institution Press, Hoover National Security Forum Series, 1999). The Federal Role in Protection and Response: p. 357.

[5] Eileen Salinsky. Senior Research Associate. *Public Health Emergency Preparedness: Fundamentals of the "System."* (Washington D.C.: The George Washington University, National Health Policy Forum, April 3, 2002). pp. 10-11.

[6] Sidney D. Drell; Abraham D. Sofaer; and George D. Wilson. Editors. *The New Terror: Facing the Threat of Biological and Chemical Weapons.* (Stanford, California: Stanford University, Hoover Institution Press, Hoover National Security Forum Series, 1999). Living Nightmares: p. 43.

[7] Ibid. Living Nightmares. p. 44.

[8] Ibid. BCW Attack Scenarios. p. 77.

[9] Ibid. Introductory Remarks. p. 332.

[10] Ibid. The Federal Role In Protection and Response. pp. 348-349.

[11] Ibid. pp. 354-355.

[12] Ibid. Toward A National Defense Strategy. p. 365.

[13] Matt Crenson. "U.S. Health Departments Experiment With Creative Ways to Detect Bioterror Attacks." *Associated Press Worldstream*. (November 6, 2002). p. 1. Retrieved from Internet: February 10, 2003.
http://web.lexis-nexis.com/universe/document? m=cb9fb488a287f42cc74f0cla8196f517&

[14] Barbara F. Bullock. *Surveillance and Detection: A Public Health Response to Bioterrorism*. (Maxwell Air Force Base, Alabama: Air University, USAF Counterproliferation Center, The Counterproliferation Papers, Future Warfare Series, No. 12, February 2002). p. 11.

[15] Ibid. p. 11.

[16] Ibid. p. 12.

[17] Ibid. p. 15.

[18] Ibid. pp. 15-16.

[19] Eileen Salinsky. Senior Research Associate. *Public Health Emergency Preparedness: Fundamentals of the "System. "* (Washington D.C.: The George Washington University, National Health Policy Forum, April 3, 2002). p. 39.

[20] Ibid. p. 38.

[21] Ibid. p. 39.

[22] Ibid. pp. 40-44.

[23] Jeffrey D. Gunzenhauser, MD, MPH. Preventive Medicine Staff Officer. "ESSENCE-Electronic Surveillance System for the Early Notification of Community-based Epidemics. (Falls Church, Virginia: U.S. Army, Office of the Surgeon General, Information Paper, February 7, 2003). pp. 1-2.

[24] Douglas F. Ramsey. "US Chemical and Biological Defense Programs Accelerate." *Janes Chem-Bio Web.* (Janes Terrorism Intelligence Centre, January 23, 2003). p. 1. Retrieved from Internet: February 24, 2003.
http://www4.ianes.com/search97/vsvts?action=View&VdkVgwKey=/contentl/janesdata/g

[25] Ibid. p. 2.

[26] Ibid. pp. 2-3.

[27] Ibid. p. 3.

[28] Ibid. p. 3.

[29] Susan Sample. Editor. "Surveillance Systems Give First Alert." *Health Sciences Report.* (Salt Lake City, Utah: University of Utah, Vol. 26, No. 2, Summer 2002). p.1. Retrieved from Internet: March 2, 2003.
http://uuhsc.utah.edu/pubaffairs/hsr/summer2002/su

[30] Ibid. pp. 3-5.

[31] Ibid. p. 4.

[32] Bruce Steele. "Responding to the Threat of Bioterrorism." *University Times.* (University of Pittsburgh, Vol. 35, No. 3, September 26, 2002). p. 2. Retrieved from Internet: March 8, 2003. http://www.pitt.edu/utimes/issues/35/020926/10.html

[33] Matt Crenson. "U.S. Health Departments Experiment With Creative Ways to Detect Bioterror Attacks." *Associated Press Worldstream*. (November 6, 2002). p. 2. Retrieved from Internet: February 10, 2003.
http://web.lexis-nexis.com/universe/document? m=cb9fb488a287f42cc74fDcla8196f517&

[34] Ashok Selvam. "Kansas City's Early Warning System." *Hospitals & Health Networks.* (Vol. 76, Issue 9, September 2002). p. 1. Retrieved from Internet: January 30, 2003.
http://t)roquest.umi.com/pgdweb?Did=000000199318881 &Fmt=3 &Deli=1 &Mtd=1 &Idx

[3s] Marianne K. McGee. "Medical Project Aims to Spot Bioterrorism." *Information Week*. (October 7, 2002). pp.1-2. Retrieved from Internet: February 10, 2003.
http://web.lexis-nexis.com/universe/document? m=c46f657d2cc6b7ec824c009526b96289

[36] Bill Scanlon. "Bioterror Surveillance: Denver Among Cities to Report Flu-like Syptoms to Feds." *Rocky Mountain News.* (October 3, 2002). pp.1-2. Retrieved from Internet: February 10, 2003.
http://web.lexis-nexis.com/universe/document? m=c46f657d2cc6b7ec824c009526b96289

[37] Paula S. Davis. Siemans Medical Solutions. "Pennsylvania Enlists Siemans in Statewide Program to Combat Bioterrorism." *PR Newswire.* (January 21, 2003). pp.1-2.
Retrieved from Internet: February 10, 2003.
http://web.lexis-nexis.com/universe/document? m=c46f657d2cc6b7ec824c009526b96289

[38] Trish Perl, MD, Msc. Infectious Disease Physician and Hospital Epidemiologist. "Bio-defense & Disaster Preparedness." (Baltimore, Maryland: Johns Hopkins University School of Medicine, Corporate Presentation to ICAF Health Care Industry Study, March 20, 2003).

[39] Sam Nunn. Co-Chairman, Nuclear Threat Initiative. "Transcript of Press Conference with the World Health Organization and Nuclear Threat Initiative." *Federal News Service.* (December 2, 2002). p.1. Retrieved from Internet: February 10, 2003.
http://web.lexis-lexis.com/universe/document? m=413785e6288153f22cafac5e4458cceb

[40] Susan Sample. Editor. "Surveillance Systems Give First Alert." *Health Sciences Report.* (Salt Lake City, Utah: University of Utah, Vol. 26, No. 2, Summer 2002). p. 1. Retrieved from Internet: March 2, 2003.
http://uuhsc.utah.edu/pubaffairs/hsr/summer2002/su

[41] Margaret A. Hamburg. Vice President for Biological Programs at the Nuclear Threat Initiative. Editorial. "Public Health Preparedness. *Science Magazine.* (Vol. 295, February 22, 2002). p. 1.

[42] Sidney D. Drell; Abraham, D. Sofaer; and George D. Wilson. Editors. *The New Terror: Facing the Threat of Biological and Chemical Weapons.* (Stanford, California: Stanford University, Hoover Institution Press, Hoover National Security Forum Series, 1999). Commentary. p. 393.

[43] U.S. Senate Committee on Governmental Affairs. *The State of Public Health Preparedness for Terrorism Involving Weapons of Mass Destruction: A Six-Month Report Card.* (April 18, 2002). 107th Congress. Second Session. S. Hrg. 107-507. Washington, D.C.: U.S. Government Printing Office, 2002. pp. 39; 67-73.

[44] Sidney D. Drell; Abraham, D. Sofaer; and George D. Wilson. Editors. *The New Terror: Facing the Threat of Biological and Chemical Weapons.* (Stanford, California: Stanford University, Hoover Institution Press, Hoover National Security Forum Series, 1999). Overview. p. xxv.

[45] Lawrence Gostin; Jason Sapsin; Stephen Teret; Scott Burris; Julie Mair; James Hodge; Jon Vernick. "The Model State Emergency Health Powers Act." *Journal of the American Medical Association.* (Vol. 288, No.5, August 7, 2002). pp. 1-2. Retrieved from Internet: March 5, 2003.
http://iama.ama-assn.org/issues/v288n5/ffull/jlm20012.html.

[46] Robin J. Strongin. Consultant. *Emergency Preparedness from a Health Perspective: Preparing for Bioterrorism at the Federal, State, and Local Levels.* (Washington D.C.: The George Washington University, National Health Policy Forum, October 2001). p. 3.

[47] U.S. Senate Committee on Governmental Affairs. *The State of Public Health Preparedness for Terrorism Involving Weapons of Mass Destruction: A Six-Month Report Card.* (April 18, 2002). 107th Congress. Second Session. S. Hrg. 107-507. Washington, D.C.: U.S. Government Printing Office, 2002. P. 2.

Bibliography

Brewin, Bob. "Anthrax Threat Exposes IT Ills." *Computerworld. (Vol.* 35, Issue 43, October 22, 2001). Retrieved from Internet: January 30, 2003. http://web8.epnet.com/citation.asp?tb=1& ug=dbs+0+ln+en%2Dus+sid+9C8149B8%2D6

Broad, William J. and Miller, Judith. "Health Data Monitored for Bioterror Warning." *The New York Times.* (January 27, 2003). Retrieved from Internet: February 3, 2003. http://proquest.umi.com/pgdweb?TS=1044294008&RQT=309&CC=2&Dtp=l &Did=0000

Bullock, Barbara F. *Surveillance and Detection: A Public Health Response to Bioterrorism*. (Maxwell Air Force Base, Alabama: Air University, USAF Counterproliferation Center, The Counterproliferation Papers, Future Warfare Series, No. 12, February 2002).

Crenson, Matt. "U.S. Health Departments Experiment With Creative Ways to Detect Bioterror Attacks." *Associated Press Worldstream*. (November 6, 2002). Retrieved from Internet: February 10, 2003. http://web.lexis-nexis.com/universe/document? m=cb9fo488a287f42cc7410c1a8196f517&

Davis, Paula S. Siemans Medical Solutions. "Pennsylvania Enlists Siemans in Statewide Program to Combat Bioterrorism." *PR Newswire.'* (January 21, 2003). Retrieved from Internet: February 10, 2003. http://web.lexis-nexis.com/universe/document?m=c46f657d2cc6b7ec824c009526b96289

Drell, Sidney D.; Sofaer, Abraham, D.; and Wilson, George D. Editors. *The New Terror: Facing the Threat of Biological and Chemical Weapons.* (Stanford, California: Stanford University, Hoover Institution Press, Hoover National Security Forum Series, 1999).

Gostin, Lawrence; Sapsin, Jason; Teret, Stephen; Burris, Scott; Mair, Julie; Hodge, James; Vernick, Jon. "The Model State Emergency Health Powers Act." *Journal of the American Medical Association. (Vol.* 288, No.5, August 7, 2002). Retrieved from Internet: March 5, 2003. http://iama.ama-assn.org/issues/v288n5/ffull/jlm20012.html.

Gunzenhauser, Jeffrey D., MD, MPH. Preventive Medicine Staff Officer. "ESSENCE-Electronic Surveillance System for the Early Notification of Community-based Epidemics. (Falls Church, Virginia: U.S. Army, Office of the Surgeon General, Information Paper, February 7, 2003).

Hamburg, Margaret A. Vice President for Biological Programs at the Nuclear Threat Initiative. Editorial. "Public Health Preparedness. *Science Magazine. (Vol.* 295, February 22, 2002).

Hamburg, Margaret A. Vice President for Biological Programs at the Nuclear Threat Initiative. Science Essay. "Facing Up to the Threat of Biological Terrorism." *The Washington Times.* (October 2002). Retrieved from the Internet: February 3, 2003. http://proquest.umi.com/pgdweb?Did=000000121989992&Fmt=3&Deli=1 &Mtd=1 &Idx

Hawkins, Dana. "Early Outbreak Alert: Computers Aim to Spot Bioterrorism Attacks-and Win Valuable Time to Save Lives of Victims." *U.S. News & World Report. (Vol.* 131, Issue 21, November 19, 2001). Retrieved from Internet: February 3, 2003. http://proquest.umi.com/pgdweb?TS=1044294392&RQT=309&CC=2&Dtp=1 &Did=O

Kayyem, Juliette N. *US. Preparations for Biological Terrorism: Legal Limitations and the Need for Planning.* (Cambridge, Massachusetts: Harvard University, The John F. Kennedy School of Government, Belfer Center for Science and International Affairs and the Taubman Center for State and Local Government, Executive Session on Domestic Preparedness, March 2001).

Lazarus, R., Kleinman, K., Dashevsky, I., Adams C., Kludt P., DeMaria A., and Platt, R. "Use of Automated Ambulatory-Care Encounter Records for Detection of Acute Illness Clusters, Including Bioterrorism." *Emerging Infectious Diseases. (Vol.* 8, Issue 8, August 2002). Retrieved from Internet: February 5, 2003. InfoTrac Web: InfoTrac OneFile.

McGee, Marianne K. "Medical Project Aims to Spot Bioterrorism." *Information Week.* (October 7, 2002). Retrieved from Internet: February 10, 2003. http://web.lexis-nexis.com/universe/document? m=c46f657d2cc6b7ec824c009526b96289

Meckler, Laura. "U.S. to Deploy Environmental Monitors Around the Country to Guard Against Bioterror Attack." *The Associated Press.* (January 22, 2003). Retrieved from Internet: February 10, 2003. http://web.lexis-nexis.com/universe/document? m=c46f657d2cc6b7ec824c009526b96289

Nunn, Sam. Co-Chairman, Nuclear Threat Initiative. "Transcript of Press Conference with the World Health Organization and Nuclear Threat Initiative." *Federal News Service.* (December 2, 2002). Retrieved from Internet: February 10, 2003. http://web.lexis-lexis.com/universe/document? m=413785e6288153f22cafac5e4458cceb

Perl, Trish, MD, Msc. Infectious Disease Physician and Hospital Epidemiologist. "Bio-defense & Disaster Preparedness." (Baltimore, Maryland: Johns Hopkins University School of Medicine, Corporate Presentation to ICAF Health Care Industry Study, March 20, 2003).

Ramsey, Douglas F. "US Chemical and Biological Defense Programs Accelerate." *Janes Chem-Bio Web.* (Janes Terrorism Intelligence Centre, January 23, 2003). Retrieved from Internet: February 24, 2003. http://www4.janes.com/search97/vsvts?action=View&VdkVgwKey=/contentl/janesdata/g

Salinsky, Eileen. Senior Research Associate. *Public Health Emergency Preparedness: Fundamentals of the "System. "* (Washington D.C.: The George Washington University, National Health Policy Forum, April 3, 2002).

Sample, Susan. Editor. "Surveillance Systems Give First Alert." *Health Sciences Report.* (Salt Lake City, Utah: University of Utah, Vol. 26, No. 2, Summer 2002). Retrieved from Internet: March 2, 2003. http://uuhsc.utah.edu/pubaffairs/hsr/summer2002/su

Scanlon, Bill. "Bioterror Surveillance: Denver Among Cities to Report Flu-like Syptoms to Feds." *Rocky Mountain News.* (October 3, 2002). Retrieved from Internet: February 10, 2003. http://web.lexis-nexis.com/universe/document? m=c46f657d2cc6b7ec824c009526b96289

Selvam, Ashok. "Kansas City's Early Warning System." *Hospitals & Health Networks.* (Vol. 76, Issue 9, September 2002). Retrieved from Internet: January 30, 2003. http://proquest.umi.com/pgdweb?Did=000000199318881 &Fmt=3 &Deli=1 &Mtd=l &Idx

Simpson, Roy. "Our First Line of Defense Against Bioterrorism, Part 2." *Nursing Management. (Vol.* 33, Issue 5, May 2002). Retrieved from Internet: February 3, 2003. http://proquest.umi.com/pgdweb?Did=000000121989992&Fmt=3&Deli=1 &Mtd=1 &Idx

Smith, Brad. "Biodefense R&D in the Department of Homeland Security." *Biodefense Quarterly*. (Baltimore, Maryland: The Johns Hopkins University, The Johns Hopkins Center for Civilian Biodefense Strategies, Vol. 4, No. 3, Winter 2003).

Steele, Bruce. "Responding to the Threat of Bioterrorism." *University Times.* (Pittsburgh, Pennsylvania: University of Pittsburgh, Vol. 35, No. 3, September 26, 2002). Retrieved from Internet: March 8, 2003. http://www.pitt.edu/utimes/issues/35/020926/10.html

Strohm, J. Elizabeth. "New Software to Help Monitor Bioterrorism Outbreaks." *The Pitt News via U-Wire.* (Pittsburgh, Pennsylvania: University of Pittsburgh, University Wire, December 4, 2002). Retrieved from Internet: February 10, 2003. http://web.lexis-nexis.com/universe/document? m=34c4b0295793944b3fc4980723ac589f

Strongin, Robin J. *Emergency Preparedness from a Health Perspective: Preparing for Bioterrorism at the Federal, State, and Local Levels.* (Washington D.C.: The George Washington University, National Health Policy Forum, October 2001).

U.S. Senate Committee on Governmental Affairs. *The State of Public Health Preparedness for Terrorism Involving Weapons of Mass Destruction: A Six-Month Report Card.* 107th Congress. Second Session. S. Hrg. 107-507. (April 18, 2002.). Washington, D.C.: U.S. Government Printing Office, 2002.

U.S. House of Representatives Subcommittee on Oversight and Investigations, Committee on Energy and Commerce. *A Review of Federal Bioterrorism Preparedness Programs: Building An Early Warning Public Health Surveillance System*. *107th* Congress. First Session. Serial No. *107-71*. (November 1, *2001).* Washington, D.C.: U.S. Government Printing Office, *2002.*

U.S. Senate Committee on Governmental Affairs. *Federal Efforts to Coordinate and Prepare the United States for Bioterrorism: Are They Ready? 107th* Congress. First Session. S. Hrg. *107-213*. (October *17, 2001).* Washington, D.C.: U.S. Government Printing Office, *2002.*

Ward, Judith A. *Homeland Defense: Are We There Yet?* (Maxwell Air Force Base, Alabama: Air University, USAF Counterproliferation Center, The Counterproliferation Papers, Future Warfare Series, No. 11, April *2001).*